

Neuroscience Exam 1, 2, 3
(Practical Exam structure list)

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Old Neuroscience Exams **CAVEAT**: Please note that copies of old neuroscience exams placed on reserve may still contain questions that were miskeyed, dropped or bonused after the exam was given. Furthermore, information or interpretations given in class 1 or 2 years ago may have become outdated. Answers marked in these tests have not necessarily been updated following such changes and the management disavows any responsibility for their accuracy. These tests should be used as a general resource to learn types of questions asked and areas most likely to be covered in exams. They should **NOT** be used as a compendium of answers to be memorized.

Choose the **BEST** answer.

1. A major pathway of the auditory system is:
 - A. Medial lemniscus
 - B. Central tegmental tract
 - * C. Trapezoid body
 - D. Medial longitudinal fasciculus
 - E. Anterior commissure

2. Which property of sound is coded by location along the cochlear spiral?
 - * A. Frequency
 - B. Intensity
 - C. Location in space
 - D. Starting time
 - E. Amplitude change

3. A structure whose proper function is critical for the maintenance of equal air pressures on both sides of the tympanic membrane is:
 - A. Stapedius
 - * B. Eustachian tube
 - C. Stria vascularis
 - D. Basilar membrane
 - E. Malleus

4. Most of the surface membrane of auditory hair cells is bathed by:
 - A. Endolymph
 - B. Fluid with relatively high potassium concentration
 - C. Cerebrospinal fluid
 - * D. Fluid with relatively high sodium concentration
 - E. Fluid from scala media

5. Most neurons of the auditory nerve:
 - A. Are pseudounipolar
 - B. Synapse with outer hair cells
 - C. Project to the inferior colliculus
 - D. Do not have spontaneous activity
 - * E. Have myelinated axons

6. Neurons of the cochlear nucleus which have a major role in sound localization are:
 - * A. Spherical bushy cells
 - B. Octopus cells
 - C. Fusiform cells
 - D. Granule cells
 - E. Purkinje cells

7. A feedback projection to the cochlea originates in:
 - A. Inferior colliculus
 - * B. Superior olivary complex
 - C. Medial geniculate
 - D. Cochlear nucleus
 - E. Lateral lemniscus

8. The pathway that subserves the vestibulo-ocular reflex is the:
 - A. Lateral lemniscus
 - B. Lateral vestibulospinal tract
 - C. Medial lemniscus
 - D. Vestibulocretiform body
 - * E. Medial longitudinal fasciculus

9. A difference between vestibular and auditory hair cells is:
 - A. Auditory hair cells have axons
 - B. Vestibular hair cells are pseudounipolar, whereas auditory hair cells are bipolar
 - C. Vestibular hair cells are surrounded by perilymph, whereas auditory hair cells are surrounded by endolymph
 - * D. In adults, vestibular hair cells have a kinocilium, whereas auditory hair cells do not
 - E. Depolarization of auditory hair cells during stimulation results from potassium entry, whereas depolarization of vestibular hair cells during stimulation results from sodium entry

10. Which of the following occur(s) during a head rotation that activates vestibular nerve fibers innervating the ampulla of the left horizontal semicircular canal?
 - A. The hair cells of the left horizontal semicircular canal are depolarized mostly by entry of sodium ions
 - * B. The cupula of the left horizontal semicircular canal is bent by endolymph pushing against it
 - C. The cupula of the right horizontal semicircular canal is not bent
 - D. The cilia of the hair cells in the right horizontal semicircular canal bend toward the kinocilium
 - E. All of the above

11. The part of the cerebellum most directly involved in vestibular function is the:
 - * A. Flocculonodular lobe
 - B. Hemisphere
 - C. Anterior lobe
 - D. Dentate nucleus
 - E. Truncus

12. The audiogram of a patient shows a large hearing loss on the left side for air-conducted sounds, but not very much loss for transmission by bone conduction. This would be consistent with:
- A. Ototoxic drug damage to inner ear
 - B. Acoustic neuroma on left
 - C. Damage from exposure to loud noise
 - * D. Otitis media in left ear
 - E. All of the above
13. In testing vestibular function by the balancing test:
- A. The subject's eyes are open so that visual input can be evaluated.
 - * B. The subject may be made to stand on foam to decrease somatosensory input.
 - C. The subject's head is tilted so that cold water can be poured into the external auditory canal.
 - D. Each labyrinth may be tested separately.
 - E. All of the above
14. A common characteristic of otosclerosis is:
- A. Fluid in the middle ear
 - B. Spongy bone formation around the malleus and tympanic membrane
 - * C. Conductive hearing loss for all frequencies
 - D. Excessive bending of cilia on outer hair cells
 - E. Increased endolymph pressure
15. Which of the following is not true of eighth nerve tumors?
- A. They most often result from abnormal growth of cells of the vestibular nerve sheath
 - B. They usually occur on just one side
 - C. Hearing loss is commonly an early symptom
 - D. Loss of facial sensation may occur as a later-developing symptom
 - * E. They are usually highly malignant

Use the following key to answer questions 16 to 19: match the cortical region and the cerebral lobe

- A. Frontal lobe
- B. Occipital lobe
- C. Parietal lobe
- D. Temporal lobe
- E. More than one of the above

16. Primary auditory cortex D

17. Primary motor cortex A

18. Primary somatosensory cortex C

19. Primary visual cortex B

Choose the Best answer.

20. Normally, the internal carotid arteries and their main branches are the principal supply of blood to which region(s) of the central nervous system?
- A. Primary visual cortex
 - * B. Primary motor cortex
 - C. Pons
 - D. Midbrain
 - E. More than one of the above
21. Normally, the vertebral and basilar arteries and their main branches are the principal supply of blood to which region(s) of the central nervous system?
- A. Primary visual cortex
 - B. Primary motor cortex
 - C. Pons
 - D. Midbrain
 - * E. More than one of the above
22. Both inositol trisphosphate (IP_3) and diacylglycerol:
- A. activate protein kinases.
 - B. are formed from a second messenger.
 - * C. are produced by phospholipase C.
 - D. increase release of Ca^{2+} from the endoplasmic reticulum.
 - E. interact with a G protein.
23. A G protein is **not** involved in which of the following?
- A. Activation of adenylate cyclase
 - B. Inhibition of adenylate cyclase
 - C. Activation of phospholipase C
 - D. Direct activation of an ion channel
 - * E. Ligand-gated receptor activation
24. The neuromuscular junction contains a(n):
- A. G protein-coupled receptor.
 - * B. ligand-gated ion channel.
 - C. muscarinic receptor.
 - D. atropine-sensitive receptor.
 - E. enzyme which produces a second messenger.
25. The neurotransmitter receptor which leads to an increase of intracellular Ca^{2+} levels **without** a change in a plasma membrane conductance is the:
- * A. m1 muscarinic receptor.
 - B. nicotinic acetylcholine receptor.
 - C. NMDA (subtype of glutamate) receptor.
 - D. $GABA_A$ receptor.
 - E. AMPA (subtype of glutamate) receptor.

26. Unlike the muscarinic receptor, the nicotinic receptor:
- A. is linked to second messenger systems.
 - B. predominates in the brain.
 - C. can produce an inhibitory postsynaptic response.
 - D. is coupled to a G protein.
 - * E. is blocked by curare.
27. An enzyme used only in the synthesis of epinephrine is:
- A. tyrosine hydroxylase.
 - B. tryptophan hydroxylase.
 - C. dopa decarboxylase.
 - * D. phenylethanolamine-N-methyltransferase.
 - E. monoamine oxidase.
28. An enzyme used in the synthesis of both norepinephrine and serotonin is:
- A. choline acetyltransferase.
 - * B. l-aromatic amino acid decarboxylase.
 - C. monoamine oxidase.
 - D. catechol-O-methyl transferase.
 - E. tyrosine hydroxylase.
29. Ways in which levels of dopamine might be decreased in the brain include:
- A. treatment with l-dopa.
 - B. blockade of dopamine autoreceptors.
 - C. treatment with a monoamine oxidase inhibitor.
 - D. treatment with amphetamine.
 - * E. none of the above.
30. GABA can best be described as:
- A. a catecholamine.
 - B. an indoleamine.
 - C. a benzodiazepine.
 - * D. a product of glutamic acid decarboxylase.
 - E. an excitatory amino acid.
31. The benzodiazepines, such as valium, are sedatives because they:
- A. open Cl^- channels.
 - * B. enhance binding of GABA to GABA_A receptors.
 - C. promote the synthesis of GABA.
 - D. are agonists at glycine receptors.
 - E. produce presynaptic inhibition.
32. Glycine does all of the following except:
- * A. mediate presynaptic inhibition.
 - B. open Cl^- channels.
 - C. enhance the activity of NMDA receptors.
 - D. hyperpolarize neurons.
 - E. inhibit neurons in the spinal cord.

33. Which of the following is not associated with NMDA receptor activation?
- A. Increase in postsynaptic levels of Ca^{2+} .
 - * B. Binding of Mg^{2+} to the NMDA receptor.
 - C. Activation of transcription factors.
 - D. Production of a retrograde messenger.
 - E. Phosphorylation of AMPA receptors.
34. The most likely precursor for methionine enkephalin is:
- A. pro-opiomelanocortin.
 - * B. proenkephalin A.
 - C. proenkephalin B.
 - D. β -endorphin.
 - E. dynorphin.
35. Substance P...
- A. is released from large-caliber, somatosensory, primary afferent neurons.
 - B. is contained within the pro-opiomelanocortin precursor.
 - * C. mediates the perception of pain.
 - D. is released in response to activation of receptors for methionine enkephalin in the spinal cord.
 - E. none of the above
36. Which of the following inhibits neurotransmitter release?
- * A. Autoreceptors
 - B. Amphetamine
 - C. Glycine
 - D. Ca^{2+} influx into the presynaptic terminal
 - E. A retrograde messenger
37. Which of the following correctly identifies a neurotransmitter with an agent that interferes with its activity?
- A. Serotonin: tryptophan
 - * B. Acetylcholine: atropine
 - C. GABA: strychnine
 - D. Glycine: benzodiazepine
 - E. Dopamine: l-dopa
38. Anterograde (Wallerian) degeneration directly involves all of the following except:
- * a. dendrites
 - b. axons
 - c. myelin
 - d. Schwann cells
 - e. terminal boutons

39. The retrograde neuronal cell body reaction to axonal damage includes all of the following phenomena except:

- a. somatic swelling
- b. nuclear eccentricity
- c. chromatolysis
- d. neuronal death
- * e. rough endoplasmic reticulum clustering

40. Cut axons in a peripheral nerve can regrow to their target. Characteristics of such a regenerative response include all of the following except:

- a. growth along a Schwann cell basement membrane
- b. growth at 1 mm/day
- c. imprecision of regrowing axons for choosing appropriate distal band of Bunge
- * d. delay by inhibitory components in peripheral nerve myelin
- e. initial delay before growth cones traverse the injury site

41. As indicated by two-point thresholds, fingertip skin has very high tactile sensitivity. From your knowledge of receptors and innervation of fingertip skin, this sensitivity is related to a very dense innervation by:

- A. hair receptors
- B. muscle spindles
- C. golgi tendon organs
- D. meissner corpuscles
- E. none of the above

42. Stimulus transduction for proprioception primarily involves receptors associated with:

- * A. golgi tendon organs, muscle spindles, and joint receptors
- B. muscle spindles, free nerve endings, and hair follicles
- C. meissner corpuscles and merkel cells
- D. merkel cells, muscle spindles, and free nerve endings
- E. none of the above

43. Which of the following statements about somatosensory primary sensory neurons is not true?

- A. Receptor potential amplitude is related to stimulus intensity.
- B. Larger stimulus amplitudes are related to higher frequency of action potential discharge.
- * C. Slowly adapting axons respond only at the onset of stimuli.
- D. Receptor potentials must be converted to action potentials for signal conduction up axons.
- E. C-fibers conduct more slowly than A-fibers.

44. You are giving a patient (a megalosaurus named Mel-a veterinary referral) a nerve conduction test. How long should it take a normal, 6 μm diameter A-beta somatosensory fiber to conduct an action potential a distance of 36 meters?

- a. 20 seconds
- b. 0.05 seconds
- c. 0.5 minute
- d. 6 seconds
- e. 1 second

45. The fastest conducting primary somatosensory axons are associated with:
- * A. muscle spindles
 - B. free nerve endings
 - C. hair follicles
 - D. meissner corpuscles
 - E. pain receptors
46. A neuroma is a:
- A. collection of degenerated axons distal to a transection injury of a nerve
 - B. collection of normal axons passing through a fossa
 - C. high density synaptic region in the central nervous system
 - D. collection of regenerating axons entrapped in a nerve stump
 - E. form of cancer of peripheral neurons
47. Under normal conditions, a primary somatosensory neuron only conducts action potentials in one direction. This is because:
- A. action potentials cannot be conducted in the central axon proximal to the cell body
 - * B. receptor potentials can only be induced in endings of distal axons
 - C. their central axon cannot conduct without prior receptor potentials in the cell body
 - D. synapses of the central terminations are only excitatory
 - E. the refractory period for action potentials only allows signal transmission from central to distal axons
48. Which of the following structures does **not** contain distal axons of primary somatosensory neurons?
- A. maxillary nerve
 - B. sympathetic chain ganglia
 - * C. root of cranial nerve VII
 - D. brachial plexus
 - E. C1 spinal nerve
49. Thoracic and abdominal viscera are primarily innervated by primary somatosensory neurons within the:
- A. trigeminal ganglion
 - B. geniculate and petrosal ganglia
 - * C. dorsal and vagal roots
 - D. maxillary and mandibular nerves
 - E. C2-4 spinal nerves
50. Somatosensory primary neurons enter the central nervous system:
- A. only at spinal levels
 - B. at midbrain, pons, and medulla levels
 - C. only at medulla and spinal levels
 - D. at midbrain and all lower levels
 - * E. at pons, medulla, and spinal levels

51. Somatosensory primary neurons make synapses on second order neurons in all the following structures except:

- A. spinal cord grey
- B. main trigeminal nucleus
- C. solitary nucleus
- * D. dorsal column
- E. spinal trigeminal complex

52. You have a patient who has a virus that kills somatosensory peripheral neurons. The virus has killed all peripheral neurons at C1 and higher levels, and all peripheral neurons at T1 and lower levels. You would expect this patient to have residual sensory functions in the:

- A. mouth and shoulders
- B. hands, arms, and face
- C. neck, chest, abdomen, and pelvis
- * D. neck, shoulders, and upper limbs
- E. face, mouth, neck, and shoulders

53. Upon entering the central nervous system, axons of all (or nearly all) primary somatosensory neurons that terminate in the main trigeminal nucleus or spinal trigeminal nuclei travel in the:

- a. vagal root
- * b. trigeminal tract
- c. dorsal column
- d. anterolateral tract
- e. lissauer's tract

54. The somatotopic organization in the spinal cord dorsal horn is such that lower limb-to-trunk-to-upper limb inputs are represented from _____, whereas in the dorsal columns and dorsal column nuclei lower limb-to-trunk-to-upper limb inputs are represented from _____.

- * A. caudal to rostral; medial to lateral
- B. medial to lateral; rostral to caudal
- C. dorsal to ventral; caudal to rostral
- D. rostral to caudal; lateral to medial
- E. dorsal to ventral; rostral to caudal

55. Primary somatosensory neurons that terminate in the superficial I-II layers of the spinal dorsal horn and spinal trigeminal complex are characterized by:

- * A. having small diameter axons with free nerve endings at their distal ends
- B. having large myelinated axons with low threshold mechanoreceptors at their distal ends
- C. having innervation fields restricted to the face
- D. transmitting touch and proprioception modality information
- E. having axons that are classified as A-alpha fibers

56. Which of the following statements regarding synapses between primary and secondary somatosensory neurons is not true?

- a. The transmitters include the excitatory amino acid, glutamate.
- b. Synapses are usually on dendrites of second order neurons.
- * c. Each primary sensory neuron activates only one secondary neuron.
- d. Peptides, like substance P, are transmitters.
- e. Primary sensory neurons can synapse on inhibitory neurons.

57. The fibers in the left medial lemniscus transmit:
- A. pain information from the left face and outer ear
 - * B. touch information from right occiput, neck, and lower body locations
 - C. proprioception information from the left neck and lower body locations
 - D. touch and proprioception information from right face locations
 - E. temperature information from the left side of the body
58. A lesion of all primary sensory neuron axons at one level in the left dorsal column would differ from a lesion of all primary sensory neuron axons in a left spinal nerve in that:
- * A. different combinations of input modalities would be involved.
 - B. one results in a bilateral deficit whereas the other results in a unilateral deficit
 - C. one results in a contralateral deficit whereas the other results in an ipsilateral deficit
 - D. one involves only myelinated axons whereas the other involves only unmyelinated axons
 - E. one involves inputs from the face whereas the other involves inputs from the body
59. Timothy Leavanhit was admitted to the emergency room with a deep knife wound entering near the right side midline of the back at a mid-thoracic level. An MR scan indicated a complete hemisection of the right side of the spinal cord at that level. You perform a sensory evaluation of touch and pain sensitivity. You would expect to find:
- A. a loss of both touch and pain on both sides below the level of the lesion
 - B. a left side loss of touch below the lesion
 - C. a right side loss of pain below the level of the lesion and a left side loss of touch below the lesion
 - D. a loss of pain and touch below the level of the lesion on only the right side
 - * E. a right side loss of touch at and below the lesion, and a left side loss of pain at or just below the level of the lesion
60. Jacob Stoneheaven was admitted to the emergency room after suffering an apparent stroke. An MR scan indicated the right internal capsule was completely destroyed. In a sensory evaluation you would expect to find:
- A. a right side loss of touch and proprioception from the face but not from body inputs
 - B. a major bilateral loss of all somatosensory modalities from the face
 - C. a major loss of pain inputs from the right face and a major loss of touch inputs from the left body
 - D. no loss of somatosensory modalities
 - * E. a major loss of all somatosensory modalities from the left face and left body
61. A lesion from an infarct in the left primary somatosensory cortex near the longitudinal fissure would be expected to disrupt processing of information from the:
- A. left face
 - B. right face and upper limb
 - C. left and right sides of the face
 - * D. right lower limb or trunk
 - E. left upper limb

62. The trigeminothalamic system that ascends through the right pons and midbrain receives its major primary somatosensory neuron inputs from:

- * A. pain and temperature fibers of left cranial nerves V, VII, IX, and X
- B. touch fibers of right cranial nerves IX and X
- C. proprioception fibers of right dorsal roots
- D. touch fibers of right cranial nerves and dorsal roots
- E. pain and temperature fibers of right cranial nerve V

63. The decussation levels for the major ascending somatosensory pathways for touch from the body, pain from the body, touch from the face, and pain from the face, are respectively:

- A. spinal cord, medulla, medulla, medulla
- * B. medulla, spinal cord, pons, medulla
- C. spinal cord, medulla, pons, medulla
- D. medulla, medulla, pons, pons
- E. none of the above

64. The neuronal cell bodies that give rise to ascending somatosensory fibers in the right internal capsule are located in the:

- A. left ventroposterior lateral and medial nuclei
- B. left main trigeminal nucleus
- * C. right ventroposterior lateral and medial nuclei
- D. right spinal cord grey
- E. right dorsal column nuclei

65. Which of the following statements about the primary somatosensory cortex is not true?

- A. It consists of cortical areas 3a, 3b, 1 and 2.
- * B. It is located on the precentral gyrus.
- C. It is somatotopically organized.
- D. It provides inputs to parietal cortical areas 5 and 7.
- E. It receives inputs from the ipsilateral ventroposterior lateral nucleus.

66. Posterior parietal somatosensory cortical areas process information from both sides of the body due to:

- A. bilateral innervation territories of individual primary sensory neurons.
- B. ipsilateral and contralateral fiber projections from each thalamus
- C. mutations of ascending projections
- * D. projections through the corpus callosum
- E. developmental abnormalities of cortical pyramidal neurons

67. Recent studies in humans with forearm amputation injuries suggest that phantom sensations are:

- A. caused by bacterial infections of cut nerves
- * B. associated with remapping of cortical somatotopic organization
- C. a reflection of psychiatric problems
- D. caused by peripheral sprouting of face primary sensory neurons into the arm
- E. none of the above

68. Repeated use of the body surface and injuries of peripheral nerves similarly affect somatosensory system organization in that:

- * A. both cause cortical representations of specific inputs to enlarge in size.
- B. neither affect central somatosensory organization.
- C. both trigger abnormal death of central somatosensory neurons.
- D. both lead to differentiation and migration of new cortical neurons.
- E. they both influence brain organization during development but not during adulthood.

69. Parasthesia refers to:

- A. an inability to recognize objects by touch
- * B. abnormal spontaneous feelings of numbness or tingling
- C. heightened sensations to painful stimuli
- D. a condition where nonpainful stimulation of the body results in pain sensations
- E. reduced pain sensibility

70. A person enters the emergency room after suffering an apparent stroke. He has a loss of both pain and temperature sensations from his right face, and from his neck and lower body on the left side. This pattern of sensory loss is best described by a lesion:

- A. of one internal capsule.
- B. of the right anterolateral system.
- C. in the left lateral pons.
- * D. in the right lateral medulla above the inferior olive.
- E. in the left trigeminal tract.

71. The primary somatosensory cortex is somatotopically organized. This means that:

- A. touch inputs activate different cortical neurons than pain inputs.
- B. each medial-lateral strip of this cortex processes a different mix of input modalities.
- C. this cortex consists of 4 cortical areas.
- D. large areas of the body have larger cortical representations than small areas of the body.
- * E. inputs from adjacent body locations activate neurons in adjacent cortical locations.

72. All the following are major posterior parietal somatosensory cortical areas except:

- A. area 7
- B. area 39
- * C. insular cortex
- D. area 40
- E. area 5

73. You are looking through a microscope at a biopsy of cerebral cortex tissue. You see a cell that has a large cell body (50 μm diameter), a large dendrite extending from the cell body to the cortical surface, and an axon entering the white matter. This cell is :

- A. a Purkinje cell
- * B. a pyramidal cell
- C. a stellate cell
- D. a granule cell
- E. not representative of any distinct class of cortical neurons.

74. The cerebral cortex receives direct axonal input projections from all the following **except**:
- A. ventroposterior lateral (vpl) nucleus of the thalamus
 - B. ventral tegmentum
 - C. claustrum
 - * D. trigeminal complex
 - E. raphe nuclei
75. The cerebral cortex sends output fibers to a number of structures in the brain. Information from pyramidal neurons in supragranular cortical layers is typically projected to:
- A. thalamic nuclei
 - B. spinal cord
 - * C. other cortical areas
 - D. brainstem
 - E. cerebellum
76. The cerebral cortex receives thalamic axon terminals which:
- A. release amino acids and produce inhibition in cortical cells
 - B. produce inhibitory responses via release of dopamine
 - C. produce both inhibition and excitation via release of acetylcholine
 - * D. produce excitatory responses via release of amino acids
 - E. release noradrenaline to excite cortical cells
77. Your patient has a disease that selectively disrupts transmission at serotonin synapses in the cerebral cortex. From your knowledge of serotonin connections in cortex, you would predict the lesion would most directly affect inputs from _____ to _____.
- A. thalamic nuclei; cells in layers III and IV
 - B. locus ceruleus; cells in layer I
 - C. other cortical areas; supragranular layer cells
 - D. cerebellum; cells in layers II and III
 - * E. raphe nuclei; cells in all layers of cortex
78. Within the cerebral cortex, it is known that inhibitory amino acids are released by:
- * A. granule cells
 - B. nucleus basalis axon terminals
 - C. pyramidal cells
 - D. thalamic axon terminals
 - E. Purkinje cells
79. All the following structures are thought to contribute to processing of pain information **except**:
- A. cerebral cortex
 - B. Lissauer's tract
 - * C. Clarke's nucleus
 - D. spinal trigeminal complex
 - E. ventroposterior medial nucleus

80. Pain can result from peripheral sensitization mechanisms involving increased prostaglandin E_2 in inflamed tissues. This sensitization entails:
- A. lysis of proteins that serve as pain receptors in distal axons
 - B. degeneration of pain fiber axons
 - C. modulation of calmodulin in axons
 - * D. phosphorylation of voltage-gated Na^+ channels in distal axons
 - E. formation of abnormal electrical synapses on distal axons
81. Pathological pain can result from mechanisms that cause central hypersensitization of spinothalamic neurons. One mechanism for producing this central hypersensitization involves:
- A. formation of abnormal synapses between postganglionic sympathetics and spinothalamic neurons
 - * B. activation of protein kinase C and sensitization of NMDA receptors
 - C. increasing the sensitivity of GABA receptors
 - D. increasing release of inhibitory amino acids from C-fibers
 - E. none of the above
82. According to the gate-control theory of pain, pain is “gated” by:
- A. descending central circuits from the brainstem
 - B. descending circuits from cortex
 - C. hormonal actions on primary sensory neurons
 - * D. activity of nonnociceptive primary afferents
 - E. none of the above
83. Electrical synapses...
- A. underlie the predominant form of synaptic transmission in the vertebrate nervous system.
 - B. transmit signals more slowly than chemical synapses.
 - * C. are composed of gap junctions.
 - D. display a prolonged synaptic delay.
 - E. None of the above.
84. Chemical synapses...
- A. underlie the predominant form of synaptic transmission in the vertebrate nervous system.
 - B. transmit signals more slowly than electrical synapses.
 - C. are polarized into pre- and postsynaptic elements.
 - D. Transduce electrical and chemical energy.
 - * E. All of the above.
85. Which statement concerning synaptic transmission at the frog neuromuscular junction is currently thought to be true?
- A. The amplitude of an endplate potential evoked by a presynaptic action potential is constant.
 - B. Extracellular Mg^{+2} ions are required for acetylcholine to be released from vesicles.
 - C. Mean quantal content is unrelated to release probability.
 - D. A miniature endplate potential results from the release of 10 or more quanta.
 - * E. None of the above.

86. Nicotinic acetylcholine receptors in the skeletal muscle cell membrane...
- * A. are composed of 5 transmembrane subunits.
 - B. are 10-fold more permeable to Na^+ than K^+ .
 - C. couple to an ion channel via a GTP-binding protein.
 - D. are most likely to be open when no ACh is bound to the receptor.
 - E. None of the above
87. A man's tongue deviates to the right when he is asked to stick it straight out. A lesion in which of the locations listed below would best account for his deficit?
- * A. Right hypoglossal nerve.
 - B. Right glossopharyngeal nerve.
 - C. Right motor cortex.
 - D. Left trochlear nucleus.
 - E. None of the above.
88. The vagus nerve...
- A. innervates the diaphragm.
 - * B. carries GVA input from chemoreceptors in the aortic arch.
 - C. is unnecessary for swallowing.
 - D. provides postganglionic innervation to pharyngeal muscles by way of local parasympathetic ganglia.
 - E. increases heart rate when active.
89. Cranial nerves IX and X...
- A. are also called the spinal accessory and the hypoglossal.
 - B. both exit from the pons.
 - C. both innervate the thoracic viscera.
 - * D. Have efferents from, and/or afferents to, the nucleus ambiguus, the solitary nucleus, and the spinal nucleus of V.
 - E. None of the above.
90. GVE cranial nuclei...
- A. are located lateral to the sulcus limitans.
 - B. are located ventral to SVE nuclei.
 - C. include the nucleus ambiguus.
 - D. include the hypoglossal nucleus
 - * E. None of the above
91. The mesencephalic nucleus of V.
- A. lies outside of the brainstem.
 - B. sends its axons to the periphery via the maxillary branch of nerve V.
 - C. projects to the solitary nucleus.
 - * D. is analogous to a dorsal root ganglion.
 - E. None of the above.